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XII. *A Meteorological Journal, principally relating to Atmospheric Electricity; kept at Knightsbridge, from the 9th of May, 1789, to the 8th of May, 1790. By Mr. John Read; communicated by R. H. A. Bennet, Esq. F. R. S.*

Read April 14, 1791.

A DESCRIPTION of the instrument for collecting atmospheric electricity, used in the following journal.

Tab. V. represents the apparatus. AA is a round deal rod, 20 feet long, 2 inches diameter at the lower, and one inch at the upper end. Into the lower end of it is cemented a solid glass pillar B, 22 inches long; the lower end of the glass stands in a hole made for it in a pedestal of wood C, which slips on the fore-part of an iron bracket D, which is driven into the wall, and supports the whole. About 13 feet above the bracket D, is fixed to the wall a strong arm of wood E, which holds perpendicularly a strong glass tube F, through which the rod is slid gently upwards, till the glass pillar B may be lowered into the hole made for it in C. It is thus fixed, and stands 12 inches from the wall. The tube F is of sufficient width to admit a case of cork, which is fastened in the inside of it, at the part where the tube is sustained by the arm of wood E, so that the rod, when bent by the wind, cannot touch the tube or break it. The upper extremity of the rod is terminated by several sharp-pointed wires G. Two of them are

of copper, each one-eighth of an inch thick ; and, in order to stiffen the rod, as well as conduct more readily the electric fluid, one of those wires is twisted round the rod to the right hand, and the other to the left, as low down as the brass collar at the vertex of the lower funnel H, to which they are foldered, in order to render their contact perfect. The tin funnels HH serve to defend the glasses B and F from the weather, which glasses are also covered with sealing-wax to render their insulation more perfect. At a convenient height from the floor, a hole is bored through the wall at I. This hole receives a glass tube covered with sealing-wax, through which a strong brass wire proceeding from the rod is conveyed into the room, where just at the end of the glass tube it passes through a two-inch brass ball L, and proceeding a little farther, keeps suspended at its extremity a pith ball electrometer K, so that the electrometer may be about twelve inches distant from the wall. On the outside of the wall there is a wooden box M, to keep that end of the glass tube dry.

At two inches distance of the above-mentioned brass ball L, a bell N is supported by a strong wire, which passing through another hole made in the wall, is made to communicate, by means of a good metallic continuation R, with the moist ground adjoining to the house. A brass ball, three-tenths of an inch in diameter, is suspended between the bell N and ball L, by a silk thread fastened to a nail O. This ball serves for a clapper, by striking between the ball and bell, when the electrical charge of the rod is sufficiently strong.

P is a small table fixed to the wall under the bell and ball, at a convenient height above the floor, upon which Leyden bottles and other apparatus are occasionally placed. Any person versed in the science of electricity, will easily understand that this

apparatus is calculated to shew the various degrees of atmospheric electricity, and at the same time to avoid the pernicious effects which may be occasioned by thunder-storms, or in short by any great quantity of electricity in the atmosphere.

The whole perpendicular height of both parts taken together, from the moist earth to the uppermost point at the top of the rod, is 52 feet.

Finding, however, that, notwithstanding all the precaution I had taken to procure a good insulation, the moist vapour of the atmosphere, fixing upon the insulating parts of the apparatus, rendered it imperfect in moist weather; I have lately (15th of Sept. 1790) altered the situation of the same rod, so that all the insulating parts are now within the roof of the house. This I have effected by a hole through the roof of my house; by which means I now obtain a considerably more constant electricity; which, however, must not be solely attributed to the superiority of my present mode of insulating, but to the rod's being also elevated to the additional height of nine feet; so that I consider its pointed part to be at present 61 feet above the moist earth.

This improvement of the apparatus, having been made after the conclusion of this journal, will be particularly described in the next, which I am now carefully continuing.

It will be necessary just to mention the method I have pursued in forming the journal of atmospheric electricity. This has been principally by means of the signs exhibited by the pith balls K, connected with the rod. When I find these closed, and not attracted by my finger, I then write no signs of electricity. When attracted on the approach of my finger, yet not sufficiently charged to repel each other, I write weak signs of the fluid. When I find the balls open, and, on the approach of excited glass, the balls close, I write they are electrified posi-

tively ; but, if the balls open wider, I write they are electrified negatively ; and the reverse when I use sealing-wax. When the balls diverge one inch and upwards, visible sparks may be drawn at the brass ball L. When sparks are said to have been perceived in any observation, I have generally on that account omitted to note the variable quantities of divergency in the pith balls. Their utmost limit of regular divergency seems to be about five or near six inches ; above that they are unsteady and disorderly. The pith balls are near two-tenths of an inch in diameter, suspended by very fine flaxen threads (in the state it is in from the heckle) five inches long. When I mention the distance of the balls in tenths of an inch, it is to be understood as nearly so as my eye can determine.

This apparatus requires a constant attention, especially during a disturbed state of the atmosphere. From the room in which the apparatus is placed I am seldom absent one hour, excepting the time of sleep ; but, when I leave it, the last thing I do at night is to examine the state of the electricity, and, if I find the rod unelectrified, I then place the Leyden bottle on the table P, with its knob nearly in contact with the ball L. The next morning, if I find this bottle charged, I write the kind of electricity it is charged with against the day in the journal, and add, *by the night bottle*.

It is presumed, that the table is sufficiently obvious. The two columns for positive and negative electricity are used only for the first observation of each day. I use FAHRENHEIT's thermometer, suspended on the north outside of a bow window. The time of making the observation with it, and the barometer, and also of the direction of the wind, has usually been about nine o'clock in the morning.

Lastly, it may be useful to observe, that I have always found the lower though uninsulated part of the apparatus (*viz.*

the metallic connection of the bell N with the moist earth) to be in a contrary state of electricity to the upper and insulated part, where the pith balls K are suspended. See the 22d of Aug.

Having made a memorandum of the several thunder-forms which have happened in divers parts of this island, according to the information by letters, and from newspapers, I thought it useful to insert them in this journal, in order to shew whether some contemporaneous appearances in my apparatus might not be attributed to them. This seems evidently to have been the case on the 3d of September.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	May 9, 1789.
		Inches.					
May 9	NW	30.	63	o	—	neg.	Balls open about three-tenths of an inch.
10	SW	30.15	60	o	—	neg.	But very weak.
11	E	30.24	61	o	—	neg.	Barely sufficient to separate the balls.
12	E	29.91	60	small	—	neg.	The first day I have had visible sparks; weather cloudy, but fair.
13	E	29.91	61	strong	pof.	—	The weather in the forenoon a little hazy; in the afternoon a thick fog; four o'clock a little rain fell; the rod now became highly electrified positively; the bell rang briskly. I now filled several bottles with the fluid. This strong charge in the rod did not last longer than one hour, but it remained charged positively in a less degree the rest of the day. There was this day some lightning and thunder at Salisbury, and to the west of it.
14	SE	30.	56	o	pof.	—	Balls open four-tenths of an inch.
15	E	29.66	58	small	pof.	—	A.M. and P.M. negative.
16	SE	29.83	61	o	—	neg.	A.M. and P.M.
17	S	29.91	58	o	—	neg.	Balls open six-tenths of an inch.
18	SW	29.91	57	o	—	neg.	Balls open five-tenths of an inch.
19	N	30.20	54	o	—	neg.	P.M. dark heavy weather.
20	SE	30.15	56	small	—	neg.	The rod was electrified nearly the whole day.
21	E	30. 2	54	o	—	neg.	Nearly the same as the preceding day.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.					
May 22	S	29.89	58	o	pof.	—	} Just sufficient to indicate the kind. Serene weather.
23	S	29.90	59	o	pof.	—	
24	SE	29.75	60	o	pof.	—	
25	E	29.68	62	o	—	neg.	Six o'clock A.M. Soon after a fog with drizzling rain, by which the rod be- came charged positively.
26	NE	29.64	61	o	—	neg.	A.M.
27	SW	29.65	60	o	—	neg.	A.M. Balls open three-tenths of an inch.
28	SW	29.86	60	o	pof.	—	But very weak.
29	W	29.72	61	strong	pof.	—	A very cloudy morning, though at too great a height for my rod; but in the afternoon the clouds approached much nearer, and the rod became charged pretty strongly positive, which contin- ued about one hour and a quarter. I charged some Leyden bottles with the fluid, some positive, others nega- tive, for there were four gradual changes of the electricity.
30	S	29.70	56	o	pof.	—	Balls open half an inch.
31	SW	29.57	58	strong	pof.	—	Nine o'clock A.M. a heavy shower of rain fell, the rod became strongly charged with negative electricity, all the time the shower lasted, which was short and sudden. One hour after- wards, the electricity changed to a strong positive, the bell suddenly be- gan to ring, and continued to do so five minutes; the pith balls then close slowly, and open negative, and conti- nued weakly so the rest of the day. At Edinburgh, some lightning and thunder this day,
June 1	SW	29.71	53	strong	pof.	—	A cloudy showery morning. The electric charge in rod was most beautiful this day. In about six hours time I ob- served seven changes of the electricity; five of those changes were gradual. The balls opened from 3 to 4 inches, and remained so from 15 to 20 mi- nutes each opening, then gradually closed; the other two charged slowly, but closed very quick.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
June 2	SW	Inches. 29.85	63 ^o	o	pof.	—	But weak.
3	SW	29.92	62	o	pof.	—	A.M.
4	W	29.42	52	strong	pof.	—	A cool cloudy morning. The rod was pretty strongly electrified full seven hours to-day, the rest of the day but weakly so. There were 12 changes of the electricity, all gradual, except one, which was instantaneous; the balls sometimes exhibited a waving motion, and sometimes sudden jerks. There were several showers of rain, and two of hail; during the fall of hail, the rod was most powerfully electrified, the bell rang very strongly; the effects and appearances were so awful, that I kept at a good distance from the rod. A great deal of lightning on the east side of Kent and Essex this day.
5	NW	29.52	53	o	—	neg.	Balls open half an inch.
6	W	29.78	53	small	—	neg.	A.M. and P.M. positive; there were small sparks emitted from the brass ball L, and the pith balls continued closing and opening many times, without any change of kind, for full two hours.
7	NW	29.92	52	o	—	neg.	} Balls open from one to seven-tenths of an inch.
8	NW	30.18	50	o	—	neg.	
9	NW	30.12	57	o	—	neg.	
10	NW	30.25	56	o	—	—	} Weak signs, balls not open.
11	NW	30.12	55	o	—	—	
12	E	30.25	56	o	pof.	—	Balls open three-tenths of an inch.
13	E	30.28	54	o	pof.	—	Balls open five-tenths of an inch.
14	NE	30.19	51	o	—	neg.	Very cloudy weather, but at too great a height to affect the rod.
15	E	30.4	55	o	—	neg.	Balls open full half an inch.
16	E	29.90	60	o	—	neg.	Balls open near one inch.
17	S	29.81	62	strong	pof.	—	Ten o'clock A.M. a sudden shower of rain fell, by which the rod became highly electrified positively, and continued to emit small sparks at the ball L, long after the shower was over, without any change of the electricity.

Days.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
June 18	SE	Inches. 29.89	60°	small	pof.	—	The weather showery; the rod pretty well electrified.
19	SW	29.88	56	o	—	neg.	Balls open six-tenths of an inch.
20	SW	29.65	63	o	—	—	Weak signs; balls not open.
21	SW	29.71	59	small	—	neg.	This morning several heavy clouds passed over, coming from the SW, by which the rod became moderately electrified negatively. Some rain fell, which increased the electrical charge. But, in the afternoon, the wind and clouds put on a more ominous appearance; near five o'clock, began a storm of wind, rain, lightning, and thunder; but the main weight of the storm did not come near my rod. Its dire effects must be east of London: nevertheless, I had those usual beautiful appearances which attend a strong charge in the rod. The storm lasted one full hour, during which time there were five successive changes of the electricity, viz. four gradual ones, attended with sudden jerks or starts, which often diminished the divergency of the pith balls from 4 inches to 2 inches or less. After those jerks the pith balls recovered their former degree of divergency, sometimes suddenly, and at other times slowly. The other change happened instantaneously, the pith balls collapsing and opening so quickly, that the eye could barely see their motion. There were two other instantaneous closings and openings of the balls, without a change of the electricity. Much lightning at Gravesend to-day.
22	SW	29.49	56	small	pof.	—	The rod was in charge all day.
23	SW	29.54	57	small	pof.	—	Most of the forenoon. Afternoon some rain fell, and the rod became electrified negatively, and ended positively.
24	SW	29.60	61	o	—	neg.	A.M.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
June 25	NW	Inches. 29.64	55	strong	—	neg.	A very thick cloudy morning. The electric charge in the rod has been moderately strong and very fine to-day. There were five gradual changes of the electricity.
26	W	29.80	53	o	—	neg.	A.M.
27	W	29.96	52	strong	pof.	—	Cold showery weather. Except some small intervals, the rod has been strongly electrified all this day. The bell once rang briskly for a few minutes, then suddenly stopped its ringing; the pith balls closed and opened negatively, and continued so till a little after eight o'clock P.M. when they changed to positive. At Liverpool, this day, a tremendous storm of lightning, thunder, hail, and rain.
28	W	29.70	50	strong	—	neg.	A very cold morning and showery, the drops of rain were very large. The rod has been very powerfully electrified near twelve hours this day, during which time there happened eleven changes of the electricity, all gradual but one. The balls often exhibited a waving pendulous motion, without any diminution in their divergency. There were also a few of those jerks before noticed on the 21st instant.
29	W	29.90	51	strong	—	neg.	The bell rang briskly. There was no change of the electricity.
30	NW	30.10	53	o	pof.	—	Nearly all day. Weather serene and clear.
July 1	N	29.19	76	o	—	—	} Weak signs, balls not open. An even dark sky, but fair.
2	N	30.3	76	o	—	—	
3	N	30.2	79	o	pof.	—	Weather serene, very hot, and a clear sky.
4	N	30.2	80	small	pof.	—	A.M. and P.M. negative. At Glasgow, some lightning and thunder.
5	NE	29.19	74	o	—	—	Weak signs. Balls not open.
6	NE	29.17	72	small	—	neg.	A heavy dark atmosphere, but fair. At Monkilver, near Bath, much lightning and thunder.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	eg.	
		Inches.	°				
July 7	NE	29.16	69	o	—	—	} Weak signs of electricity; balls not open.
8	NE	30.	60	o	—	—	
9	NE	29.40	72	o	—	—	
10	NE	29.20	72	o	—	neg.	A.M.
11	E	29.15	74	o	—	neg.	A.M.
12	E	29.13	78	o	—	—	Balls not open.
13	W	29.5	72	small	—	neg.	A.M. and P.M. positive with sparks. At Hereford, this day, a storm of rain, lightning, and thunder.
14	SW	29.6	69	o	—	—	Weak signs; balls not open.
15	NW	28.8	52	small	—	neg.	A.M. and P.M. positive, with bright sparks. At Strichen, in Scotland, a heavy thunder storm.
16	W	30.	60	o	—	—	Balls not open. At Edinburgh, this day, some lightning and thunder.
17	SW	29.10	65	small	—	neg.	P.M. fine sparks; no change of kind. At Glasgow and Hamilton, this day, lightning, thunder, hail and rain; and also at Newcastle, in Northumberland, the storm was severe.
18	SW	29.15	59	o	—	—	Weak signs; balls not open.
19	W	29.10	50	o	—	neg.	P.M.
20	NW	29.10	54	strong	—	neg.	Three o'clock P.M. I saw a thunder storm approaching. While the storm remained at a considerable distance, the rod was very highly charged with negative electricity, and continued so three quarters of an hour; during which time distant thunder was heard. Sometimes the balls were affected with a jerking, at others a waving, motion. The wind now shifted to the SE, and a heavy rain soon came on; the electricity now changed to positive, and the bell now rings briskly; every appearance (both within and without the room) was tremendously awful. I therefore seated myself upon a large insulated stool, where I could with safety observe the apparatus. A Leyden bottle was undesignedly placed with its brass knob near to the brass

Days.	Wind.	Barom. Inches.	Ther.	Sparks.	Pof.	Neg.	
			°				<p>ball L. This bottle charged and spontaneously discharged almost as quick as I could notice them; and at the same time there was a continual flashing of dense sparks between the bell and brass ball L. These very grand appearances only lasted ten minutes, and the scene was terminated by a clap of thunder; but the storm, and its effects on the rod, lasted near two hours. I saw no lightning but what was in the apparatus. There were nine gradual changes of the electricity, from negative to positive, &c.</p> <p>I had purposely placed a large glass bowl, upon an insulated table, in the open air, to catch the falling electrified rain. As soon as the bottom of the bowl was well covered with the rain water of the above storm, to my great satisfaction, a pair of linen threads I had placed for the purpose diverged near two inches; the water remained electrified near ten minutes after it was taken into the house.</p>
July 21	SW	29.15	52	strong	—	neg.	P.M. a little rain fell, and the electricity changed to positive. At Edinburgh and Bamff, this day, there was much lightning and thunder.
22	SW	29.10	61	strong	—	neg.	A very strong electricity in the rod all the forenoon. 12 o'clock some rain fell, on which the rod became highly charged positively, the bell rang weakly for a long time, it then stopped, and the balls closed, and opened negative, and continued so full three hours. This day, near Shrewsbury, a storm of rain, lightning, and thunder.
23	W	29.10	51	strong	pos.	—	Both A.M. and P.M. and ended negative as the preceding day.
24	W	29.15	71	small	—	neg.	A.M. and P.M. positive.
25	W	29.20	71	o	—	—	} Weak signs; balls not open. An universal cloudy dark sky.
26	W	29.10	69	o	—	—	

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
July 27	N	Inches. 29.15	64°	strong	—	neg.	Four o'clock P.M. happened a sudden and short storm of wind and rain. The rod became powerfully electrified, the bell rang for 20 minutes, then stopped, and the electricity became positive, and strong. At Cambridge, this day, a tremendous storm of lightning and thunder.
28	N	29.20	74	o	pof.	—	A.M. balls open five-tenths of an inch.
29	W	30.	56	small	—	neg.	A.M.
30	NW	29.30	73	o	—	neg.	Balls open six-tenths of an inch.
31	W	29.20	75	o	—	neg.	P.M. a regular dark sky, with small rain, which lasted four hours; such rain is never electrified strongly. Air is very moist.
Aug. 1	W	29.79	60	o	—	—	} A heavy dark atmosphere, and a warm soft air. The electricity these six days amounts only to weak signs, balls not open.
2	W	30.12	56	o	—	—	
3	SE	30.	62	o	—	—	
4	E	30.5	61	o	—	—	
5	E	29.79	66	o	—	—	
6	SW	30.9	60	o	—	—	
7	W	30.27	56	o	—	neg.	P.M.
8	W	30.24	58	o	—	neg.	A.M.
9	E	30.20	66	o	—	neg.	A.M.
10	E	30.17	60	o	—	neg.	A.M.
11	NE	30.20	66	o	—	—	Balls not open.
12	E	30.16	58	strong	pof.	—	P.M. a fine shower of rain, on which the rod became pretty well electrified; but soon changed to a much more strong negative electricity, which afforded fine sparks at the brass ball L. The pith balls many times closed and opened, without any more changes of kind.
13	E	30.14	60	small	pof.	—	A.M.
14	NE	30.13	62	o	pof.	—	A.M. balls open seven-tenths of an inch.
15	NE	30.9	59	strong	pof.	—	A.M. P.M. a very black cloud passed over the rod, by which it became very strongly electrified for a few minutes only; the bell rang briskly.
16	N	30.15	62	strong	pof.	—	There has been much rain to-day, and the drops very large. The rod has been

Days.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				in high charge great part of the day. The sparks at the brass ball L were very pungent; even the air in the room, and the uninfulated bell, and other things, shewed that they were electrified. The bell rang briskly at three very different times. This strong charge of the rod continued full four hours; and the electricity, during that time, changed in kind ten times. Eight of them were gradual, two of them were quick, and attended with jerks. I heard some rumbling of thunder at a great distance. At Dunwich, in Suffolk, this day, much lightning and thunder.
Aug. 17	NE	30.26	61	small	—	neg.	A.M.
18	NE	30.32	61	o	—	neg.	Balls open nine-tenths of an inch.
19	NE	30.25	60	o	—	—	} Weak signs; balls not open.
20	E	29.95	63	o	—	—	
21	SE	29.75	63	strong	—	neg.	P.M. a strong charge in the rod, but of short duration.
22	W	29.75	56	strong	—	neg.	The rod was in high charge ten hours this day, except a few small intervals; there were nine gradual changes of the electricity, from negative to positive, and the contrary. The bell rang very briskly at three different times during that period. There were several showers of rain, and one of hail; during the latter, the electric charge in the rod was most intense; the sparks darted between the ball and bell extremely sharp and quick. I found the moisture in the air of the room was now electrified, also the bell, and its metallic connexion with the earth, and even the bricks in the wall to which the metal is fastened were all electrified with an electricity contrary to that in the insulated part of the apparatus. An electrician (who had often in vain called at my house to see

Days.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Aug. 23	W	29.94	52	strong	pof.	—	the apparatus in high charge) placed his left hand on the bell, and with his finger of the right hand approached the ball L; a dense spark issued to it, and he received a smart shock in his arms and breast, like that of the Leyden bottle. We then joined hands, and made the circuit in the usual way, between the bell and ball, and we both received a severe shock. Much lightning and thunder this day at Stirling and Dumfries, in Scotland.
24	NW	30.15	58	small	pof.	—	A.M. and P.M. negative on a fall of rain.
25	SW	30.19	60	o	pof.	—	Great part of the day.
26	SW	30.10	58	o	—	—	A.M. but very weak in the afternoon.
27	N	30. 8	59	o	—	—	} Weak signs; balls not open.
28	W	30. 3	54	o	pof.	—	
29	SE	29.90	58	o	—	—	A.M. a serene clear sky.
30	SW	29.80	60	o	—	—	} Only weak signs.
31	NW	29.75	62	o	—	neg.	
Sept. 1	SE	29.72	58	o	—	neg.	P.M. from a shower of rain, the drops of which were very large. The electricity soon changed to positive. Though every circumstance was favourable for a strong electrification, yet the charge in the rod was but weak. My suspicion led me to try the state of the uppermost end of the rod, and I found it to be in a contrary state of electricity to that at the lower end of it; the middle part of the rod was in its natural state, that is, shewed no signs of being electrified; therefore the rod was only (at this time) influentially electrified.
2	S	29.60	66	small	pof.	—	A.M. A.M. P.M. a shower of rain; the electricity became negative.
3	S	29.50	69	small	pof.	—	In the forenoon. P.M. a strong gale of wind. I now saw thunder clouds forming at a great height. Half after

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				five o'clock appearances were dreadful; in five minutes time the strong gale of wind became a storm from SE. This storm of wind (for there was but little rain) carried the huge black clouds to the NW, for there I saw abundance of red lightning a little above the horizon, and I once heard a rumbling of thunder. The rod before the storm was positive, but by it was changed to negative, and continued so during the whole time. The electricity of the rod often varied in strength, sometimes weak, sometimes strong, without change of kind. At Amertham, in Berkshire, and at the same time at the Earl of Aylesford's park, near Packington, in Warwickshire, was a most tremendous storm of hail, rain, lightning, and thunder, from 4 to 6 o'clock P.M.
Sept. 4	SE	29.50	68	small	—	neg.	P.M. There were four gradual changes of the electricity in two hours.
5	SW	30.	69	small	—	neg.	P.M. There has been a little rain to-day.
6	SW	29.95	59	small	pof.	—	P.M. and near sun-setting negative; there was some small rain.
7	SW	30. 3	62	o	pof.	—	A.M. by the night bottle; that in the rod very weak.
8	SW	30.15	67	o	—	—	} Only weak signs of electricity; balls not open.
9	SW	30.15	68	o	—	—	
10	SW	30.12	68	o	—	—	
11	N	29.95	61	o	—	—	} By the night bottle.
12	N	30.10	54	o	pof.	—	
13	W	30.10	54	o	—	—	} Weak signs; balls not open. A dark atmosphere.
14	SW	29.85	60	o	—	—	
15	W	29.82	48	o	—	—	
16	SW	29.74	48	strong	—	neg.	A.M. There were several heavy clouds passed from the SW, by which the rod was highly charged with positive electricity. The bell rang briskly. This charge lasted from a little before eleven o'clock

Days.	Wind.	Barom.	Ther. Sparks.		Pof.	Neg.	
		Inches.	°				
Sept. 17	NW	29.92	44	o	—	neg.	A.M. to full six o'clock P.M. during which time there were four gradual changes of the electricity.
18	NW	29.61	52	o	—	neg.	By the night bottle.
							A.M. a more transient visit of the electric fluid I never before saw, just while a small black cloud passed over the rod, and let fall a few drops of rain; the whole time of the charge was about 4 minutes.
19	W	29.40	48	o	—	neg.	A.M. by the night bottle. The electrification of the rod very weak.
20	W	29.40	60	o	—	—	Weak signs; balls not open.
21	W	29.40	60	small	—	neg.	A.M. by the night bottle. P.M. the rod was electrified negatively.
22	NW	30.9	51	o	—	neg.	By the night bottle, and the rod also.
23	NW	30.2	51	o	—	neg.	The electrical charge has been very weak these eight days, only just sufficient to indicate the kind.
24	NW	30.23	61	o	—	neg.	
25	NW	30.26	49	o	—	neg.	
26	S	30.26	49	o	—	neg.	
27	SW	30.	61	o	—	neg.	
28	W	30.	51	o	—	neg.	
29	S	29.71	58	o	—	neg.	
30	S	29.1	48	o	—	neg.	
Oct. 1	SW	29.22	53	small	pof.	—	A.M. by the night bottle, which was sufficiently charged to give a bright spark on making the circuit. At noon some rain fell, by which the rod became electrified negatively, and very strong, which lasted full four hours; during that time, the electricity changed four times, which were all gradual.
2	SW	29.28	47	strong	—	neg.	A.M. P.M. the rod was electrified positively, and afterwards negatively, with strong sparks at the brass ball L.
3	SW	29.11	48	strong	pof.	—	A.M. but much more strongly positive in the afternoon; the bell for a short time rang briskly, after that faintly, then stopped, and the electricity changed to negative, which continued some hours, then declined gradually to weak signs only.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Oct. 4	W	29.40	51	o	pof.	—	A.M. by the night bottle.
5	S	29.53	45	small	pof.	—	A.M. And P.M. negative.
6	S	29.50	56	small	pof.	—	A.M. P.M. the same, but much stronger. There hath been to-day a cold small rain. The electricity changed four times in two hours. This day, at Whitehaven and Lancaster, was much lightning and thunder, rain, hail, &c.
7	W	29.27	45	small	pof.	—	A.M.; but in the afternoon a much stronger positive charge.
8	E	29.20	48	o	pof.	—	A.M.
9	SW	29.29	46	o	pof.	—	A.M.
10	SE	29.50	45	o	pof.	—	A.M.
11	SE	29.80	49	o	pof.	—	A.M.
12	S	29.46	53	o	—	—	} Weak signs; balls not open. Dark, hazy weather.
13	N	29.50	53	o	—	—	
14	W	29.50	53	o	—	—	
15	W	29.52	56	o	—	—	} A.M. just sufficient to emit visible sparks.
16	W	29.67	42	small	pof.	—	
17	W	29.90	40	o	pof.	—	P.M. by means of a fog.
18	S	29.67	52	o	—	neg.	P.M. balls open six-tenths of an inch.
19	S	29.79	50	o	—	—	} Weak signs; balls not open.
20	SW	29.75	58	o	—	—	
21	S	29.89	53	o	pof.	—	A.M.
22	W	30. 4	50	o	—	—	} Weak signs of electricity; balls not open. Dark, hazy weather, and moist air.
23	NE	30. 7	53	o	—	—	
24	E	30.24	48	o	—	—	
25	NE	30.28	55	o	—	—	
26	E	30.27	47	o	—	—	
27	E	30.27	45	o	—	—	} P.M. by means of a little cold rain.
28	E	30.30	40	o	—	—	
29	N	30.13	46	o	—	—	} P.M. a very high north wind.
30	E	30. 3	40	o	pof.	—	
31	N	29.92	40	o	pof.	—	} Only weak signs of the electric fluid; balls not open. A dark, clouded atmosphere.
Nov. 1	N	30.32	38	o	—	—	
2	N	29.59	46	o	—	—	
3	S	29.19	39	o	—	—	
4	SE	29. 3	48	o	—	—	
5	S	29.29	50	o	—	—	
6	W	28.82	48	o	—	—	

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
Nov. 7	W	Inches. 28.90	43	small	—	neg.	A.M. by a shower of fleet, which for a short time occasioned the rod to emit bright sparks at the ball L.
8	NW	29.9	40	o	—	neg.	} A.M. by the night bottle.
9	W	29.29	30	o	—	neg.	
10	W	29.90	37	small	pos.	—	A.M. by means of a fog.
11	W	29.93	39	small	—	neg.	A.M.
12	SW	29.70	45	o	pos.	—	P.M. This was obtained in the following manner. Soon after sunset I perceived a light-coloured dew vapour arise 20 or 30 inches above the ground in the park; the evening being serene and fair, I stood upon an insulated stool, and waved my exploring rod among the dew *, and with my finger touched a sensible electrometer, which instantly opened with positive electricity. As the evening advanced, a strong fog filled the air; when it was of sufficient height for the high or fixed rod, this also became electrified with the same kind of electricity which I had received near the earth's surface.
13	W	29.73	40	o	—	—	} Weak signs only; balls not open.
14	SW	29.63	46	o	—	—	
15	SW	29.42	47	o	—	—	Notwithstanding all my care and attention to my pointed rod, this day it has been intirely frustrated; for I have not perceived any signs of the electric fluid. However, it is the first day it has wholly failed me. A moist air

* When I find that the moisture in the air has so far injured the insulation of my high-pointed rod, that it will not retain the electric fluid; in that case, I make use of a small rod which I hold in my hand, and project through an upper window; having first *warmed* the stool legs, I place myself upon it, &c. I find this method to be a good substitute in damp weather. The rod is about the length and strength of a fishing-rod, with plenty of small wire twined round it.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Nov. 16	SW	29.43	43	o	—	—	has prevailed for many days; and there have been six hours drizzling rain to-day, which must lessen the exactness of the insulation of the rod, and air also.
17	S	29.54	47	small	—	neg.	Weak signs; balls not open. A.M. small sparks were in the rod, the greatest part of this day.
18	S	29.51	40	o	pof.	—	} A.M. by means of a fog.
19	S	29.69	43	o	pof.	—	
20	W	29.65	47	o	pof.	—	
21	NW	29.86	44	o	—	neg.	A.M. by the night bottle, which I found well charged.
22	N	29.89	44	o	—	—	Weak signs only.
23	NE	30.12	42	o	—	—	No signs. This is the second failure. A moist atmosphere.
24	NE	30.29	41	small	pof.	—	A fog. There were visible sparks during the greatest part of the day.
25	N	30.20	37	o	pof.	—	A.M. by means of a fog.
26	N	30.30	37	small	pof.	—	A.M. and P.M. positive, with fine sparks.
27	SE	30.45	30	o	—	neg.	At break of day. Afterwards positive, by means of a fog.
28	W	30.43	33	o	pof.	—	All day, by a continued fog.
29	NW	30.30	35	small	pof.	—	All day. The fog still continues. I have observed, during these three days and three nights (abating a little time for sleep, and which I curtailed for so noble a purpose), that a foggy vapour was constantly electrified positively. The pith balls diverged from a quarter to three quarters of an inch, except when the fog (which was generally moderate) suddenly became thick and dark; then the balls would open to near two inches; at those times I received the electric fluid into bottles. This fog began strongly negative.
30	S	30.10	38	o	pof.	—	Nearly all day. The fog is entirely gone.
Dec. 1	SE	29.71	38	o	—	—	Weak signs; balls not open.
2	S	29.75	50	o	pof.	—	P.M. A moist air to-day.
3	S	29.90	39	strong	pof.	—	All day (I mean 16 hours out of 24), the weather foggy.

Days.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Dec. 4	S	30.10	43	o	—	—	} Weak signs; balls not open.
5	SW	30.38	52	o	—	—	
6	SW	30.40	48	o	—	—	
7	SW	30.49	42	o	pof.	—	} No signs of electricity. The third failure. A very moist air.
8	SW	30.54	40	small	pof.	—	
9	SW	30.55	34	o	pof.	—	
10	W	30.52	39	o	—	—	} Weak signs; balls not open.
11	SW	30.54	42	o	pof.	—	
12	SW	30.41	44	o	pof.	—	
13	SW	30.30	47	o	—	—	} A.M. and P.M. The weather serene and fair.
14	S	29.92	44	o	—	neg.	
15	SW	28.95	45	o	—	—	
16	SW	29.40	40	strong	pof.	—	} Weak signs.
17	W	29.15	38	o	—	—	
18	W	30.	50	small	pof.	—	
19	SW	29.58	44	o	—	neg.	} A.M. a fine serene morning.
20	SW	29.72	44	o	—	—	
21	SW	29.78	45	o	—	—	
22	SW	29.60	56	o	—	—	} P.M. by a small rain. On an increase of the fall of rain, the electricity changed to positive.
23	W	29.78	49	o	—	—	
24	W	29.27	52	small	—	neg.	
25	SW	29.41	42	strong	—	neg.	} No signs of electricity. The sixth day's failure. A very damp air.
26	W	29.89	46	small	pof.	—	
27	SW	29.80	46	o	—	—	
28	W	29.88	47	o	pof.	—	} No signs. The seventh day's failure. A moist air.
29	SW	29.75	54	o	—	—	
30	SW	29.76	42	o	—	—	
31	S	29.73	48	o	—	—	} Weak signs of electricity.

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
1790		Inches.	°				
Jan. 1	SW	29.90	35	o	pof.	—	Both A.M. and P.M. positive.
2	S	30.30	36	small	pof.	—	All day.
3	S	29.98	46	o	pof.	—	All the day, by a fog.
4	W	30.20	43	small	pof.	—	All the day, and bright sparks several times to-day.
5	N	30.25	45	small	pof.	—	All the day, with fine sparks.
6	SE	30.19	41	o	pof.	—	A.M.
7	W	30.40	41	small	pof.	—	A.M. weather dry and foggy.
8	W	30.45	36	small	pof.	—	Nearly all day in charge.
9	E	30.28	36	o	pof.	—	A.M. balls open near one inch.
10	SE	30.24	39	o	pof.	—	A.M. and P.M.
11	S	30.11	41	o	pof.	—	P.M.
12	W	30.20	45	o	—	—	Weak signs.
13	SW	30.34	42	o	pof.	—	A.M.
14	S	29.95	49	small	—	neg.	A.M. a small rain, by which the rod was electrified negatively.
15	NW	29.91	43	o	pof.	—	A.M.
16	SW	29.95	42	small	pof.	—	A.M. weather very mild and fair.
17	N	30.28	40	o	pof.	—	A.M.
18	NE	30.20	39	o	pof.	—	A.M. and P.M.
19	E	30.13	33	o	pof.	—	A.M. and P.M.
20	SE	30.24	32	small	pof.	—	A.M.
21	E	30.40	31	small	pof.	—	A.M. and P.M.
22	W	30.38	35	small	pof.	—	All the day, from a fog. The strength of the electric charge in the rod was much governed by the occasional intensity of the fog; for as one abated in strength so did the other, and the contrary. At ten o'clock P.M. I received bright sparks at the ball L.
23	W	30.33	40	small	pof.	—	Seven o'clock A.M. I found the rod electrified, sufficiently strong to emit visible sparks, and often afterwards the same day.
24	W	30.16	46	small	pof.	—	A.M.
25	NE	30.11	42	small	—	neg.	There was a moderate shower of rain this morning, by which the rod was electrified negatively.
26	W	30.2	40	o	pof.	—	} A.M. balls open from two to seven tenths of an inch.
27	W	29.30	42	o	pof.	—	
28	S	29.50	44	small	pof.	—	A.M. at noon fell a small rain, which was void of electricity. Near ten

Days.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Jan. 29	W	29.26	40	o	pof.	—	ten o'clock P.M. a sudden shower of rain, strongly negative.
							P.M. A delightful clear fine day, but the atmospheric electricity was very weak till night came on.
30	N	29.50	41	o	pof.	—	A.M. And P.M. negative.
31	S	29.68	46	o	pof.	—	
Feb. 1	N	29.87	40	o	pof.	—	
2	SW	30.10	40	o	pof.	—	
3	W	30.30	44	o	pof.	—	Balls open from one to nine tenths of an inch, weather fair and serene.
4	W	30.60	46	o	pof.	—	
5	SW	30.61	43	o	pof.	—	
6	W	30.63	44	o	pof.	—	
7	NW	30.35	39	o	pof.	—	
8	N	30.22	36	o	pof.	—	
9	W	30.5	40	small	pof.	—	Sparks just visible.
10	NE	30.7	43	o	pof.	—	
11	W	30.20	41	o	pof.	—	Serene weather still continues.
12	W	30.20	45	o	pof.	—	
13	SW	30.34	42	small	pof.	—	Nearly all the day, with fine bright sparks.
14	SW	30.15	44	o	pof.	—	Balls open from two to six tenths of an inch.
15	W	30.22	40	o	pof.	—	
16	S	29.95	44	o	pof.	—	A.M. A small rain P.M. which did not occasion any change in the electric fluid.
17	W	30.20	39	o	pof.	—	Balls open half an inch, weather still serene.
18	W	30.42	42	o	pof.	—	
19	S	30.48	45	o	pof.	—	
20	SE	30.42	40	small	pof.	—	A.M. A foggy day.
21	SW	30.38	42	o	pof.	—	Balls open from one to nine tenths of an inch, weather still mild.
22	SW	30.43	43	o	pof.	—	
23	S	29.97	46	o	pof.	—	
24	SW	30.15	44	o	pof.	—	
25	S	29.99	51	o	pof.	—	
26	W	29.88	51	o	pof.	—	P.M. I have often observed that impetuous winds lessen the intensity of atmospheric electricity in clear weather, which has been verified this day; for not the least sign of electricity could be obtained from the rod till after sunset, at which time the high west wind hav-

Day.	Winds.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	°				
Feb. 27	W	30.20	42	o	—	—	ing subsided, a little low vapour sprung up; I then received the fluid in great plenty, and of the same kind that it has continued to be for twenty-seven days past.
28	NW	30.22	45	o	—	—	} Weak signs: balls not open.
Mar. 1	N	30.32	47	o	pof.	—	
2	NW	30.49	50	small	pof.	—	A.M. sparks just visible.
3	N	30.33	49	o	pof.	—	} Very mild serene weather.
4	NW	30.27	40	o	pof.	—	
5	NE	30.31	43	o	pof.	—	
6	NW	30.47	40	o	pof.	—	
7	NW	30.45	42	o	pof.	—	
8	SW	30.44	42	small	pof.	—	A.M. visible sparks. Still no change of kind.
9	SW	30.20	41	o	pof.	—	A.M.
10	SW	29.90	46	o	pof.	—	P.M. A strong gale of wind to-day. The atmosphere is extremely dry. The sun appeared bright all day. No atmospheric electricity could be obtained till near ten o'clock at night. This day, at Hallifax, fell a shower of snow, accompanied with one flash of lightning and one clap of thunder.
11	SW	30.20	41	o	pof.	—	} A.M. Still moderate weather.
12	S	30.31	51	o	pof.	—	
13	SW	30.20	41	o	pof.	—	A.M. Nine o'clock P.M. to eleven o'clock there was a moderate shower of rain, which was electrified negatively. I have not till this perceived a negative charge since January the 28th.
14	NW	30.50	49	o	pof.	—	A.M. At Thurso, in Scotland, hail, lightning, and thunder.
15	N	30.57	51	o	pof.	—	P.M.
16	N	30.60	40	small	pof.	—	A.M. visible sparks.
17	NE	30.60	40	o	pof.	—	} A.M. a very dry atmosphere.
18	NE	30.50	45	o	pof.	—	
19	E	30.55	44	o	pof.	—	A.M. there was an hoar frost upon the grass this morning.
20	E	30.44	43	o	pof.	—	
21	E	30.39	44	o	pof.	—	A.M.

Days.	Wind.	Barom.	Ther	Sparks.	Pof.	Neg.	
		Inches.	°				
Mar. 22	E	30.15	42	o	pof.	—	} A.M. divergency of the pith balls from one to nine tenths of an inch.
23	SW	29.81	46	o	pof.	—	
24	S	29.80	51	o	pof.	—	
25	NW	30.	46	o	pof.	—	
26	E	30.4	48	o	pof.	—	
27	E	30.	46	o	—	neg.	A.M. from a small shower of rain. P.M. the fluid was positive.
28	NE	29.98	44	o	pof.	—	P.M.
29	N	30.	48	o	pof.	—	P.M. the air a little foggy.
30	E	29.95	44	o	pof.	—	A.M. not a beam of sun has appeared this day.
31	E	29.93	47	o	pof.	—	A.M. balls half an inch open.
April 1	E	30.5	45	o	pof.	—	A.M.
2	E	30.20	41	small	pof.	—	A.M. visible sparks.
3	E	30.25	40	o	pof.	—	} Balls open from one to seven tenths of an inch.
4	E	30.19	40	o	pof.	—	
5	NE	30.23	47	o	pof.	—	
6	E	29.95	36	o	pof.	—	} Weak signs of electricity. This weak state has not happened since the 31st of December. There has been for many days a strong east dry wind, which seems hitherto nearly void of the electric fluid.
7	E	29.75	45	o	—	—	
8	E	29.75	52	o	—	—	
9	E	29.57	66	small	—	neg.	P.M. from a fine shower of rain.
10	E	29.50	40	small	—	neg.	A.M. the rain continues, so does its negative electricity.
11	E	29.36	35	small	pof.	—	A.M. from a little fall of snow. P.M. some snow mixed with rain, on which the rod became charged much more strongly positive. The rod has been charged full four hours to-day.
12	E	29.35	39	o	—	—	Weak signs; balls not open.
13	E	29.70	38	small	—	neg.	A.M. a moderate rain, but strongly electrified, and continued so full two hours. There were two gradual changes of electricity.
14	NE	29.81	41	o	—	neg.	P.M. but after sunset the rod was electrified positively.
15	E	29.68	35	small	—	neg.	Six o'clock A.M. a little rain fell. Half after eight o'clock, a fine shower of

April

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
		Inches.	o				
April 16	NE	29.85	41	o	pof.	—	<p>snov; the rod now became strongly electrified positively. Dense sparks were now received at the ball L; half after nine o'clock, the electricity changed to negative. I caught some of the snov in the apparatus mentioned the 20th of July in this journal, and I found it weakly electrified.</p> <p>Divergency of the pith balls was from a tenth to seven-tenths of an inch. Fine serene weather.</p>
17	N	29.98	42	o	pof.	—	
18	NE	29.80	40	o	pof.	—	
19	NE	29.69	41	o	pof.	—	
20	SE	30.26	45	o	pof.	—	
21	S	30.23	47	o	pof.	—	
22	S	29.94	51	o	pof.	—	
23	SW	29.70	55	o	pof.	—	
24	W	29.55	52	o	pof.	—	
25	SW	29.60	51	strong	pof.	—	
26	NE	29.85	53	small	pof.	—	<p>A M. and P.M. negative from a little fall of rain.</p> <p>Half past nine o'clock A.M. A distinct black cloud approached the rod, and some heavy drops of rain fell; the electricity of the rod then changed to negative. About half past three o'clock P.M. a very large low cloud passed over the rod, and rained a little, on which the rod became strongly electrified positively.</p>
27	N	29.98	47	o	pof.	—	<p>A.M. P.M. on the fall of some rain, the rod was charged negatively.</p> <p>The divergency of the balls from two to six tenths of an inch. Serene fine weather.</p>
28	W	29.80	50	o	pof.	—	
29		29.69	51	o	pof.	—	
30		29.58	53	o	pof.	—	
May 1	E	29.75	50	small	pof.	—	<p>Nine o'clock A.M. a shower of rain; the electricity now became negative. The rod has been electrified to-day from six o'clock A.M. to ten o'clock P.M. and I suppose all night also.</p>
2	N	30.22	41	o	pof.	—	<p>Divergency of the pith balls from three to seven tenths of an inch.</p>
3	NE	29.85	49	o	pof.	—	
4	SE	29.63	51	small	pof.	—	

Days.	Wind.	Barom.	Ther.	Sparks.	Pof.	Neg.	
May 5	S	Inches. 29.73	52°	strong	pof.	—	Six o'clock, A.M. very cloudy. Eight o'clock it rained, the electricity now became strongly negative, with fine sparks at the ball L. This shower having ceased, another soon followed, which electrified the rod positively. The rod was charged 7 hours to-day.
6	SW	29.75	50	small	—	neg.	Every appearance at the rod to-day was nearly as during the preceding one.
7	W	30.10	56	o	pof.	—	Balls open from one to five tenths of an inch. Such weak signs of electricity, as have been observed for these two days, are the usual effects of a very strong and dry westerly wind; and in general, let a strong dry wind blow from what point of the compass it may, it is attended with weak signs of electricity.
8	W	29.84	50	o	pof.	—	

The above-mentioned eighth day of May completes this journal of one whole year, which I give to the curious in atmospheric electricity as a faithful narrative of facts, having never once deputed another person to make observations for me.

JOHN READ,
of Knightsbridge, near London.

A monthly

A monthly account of electrical sparks, and of positive and negative electricity, as indicated by the pith-ball electrometer, and sometimes by only flaxen threads without balls to them.

		Number of days in each month in which sparks were perceived.		
		Times.	Times.	Days.
23 days of May, 1789,	} Positive	17	Negative 18	9
8 days of May, 1790,				
June	Positive	32	Negative 36	12
July	Positive	13	Negative 22	12
August	Positive	19	Negative 19	9
September	Positive	9	Negative 23	7
October	Positive	17	Negative 7	7
November	Positive	12	Negative 8	8
December	Positive	12	Negative 6	7
January	Positive	26	Negative 4	13
February	Positive	26	Negative 0	3
March	Positive	30	Negative 1	3
April	Positive	28	Negative 12	8
		241	156	98

It appears from this journal, that there were only *seven* days throughout the year in which no signs of electricity were perceived; *viz.* the 15th and 23d of November, and the 6th, 15th, 17th, 21st, and 22d of December.

Remarks on the phænomena exhibited by the rod on the 31st of August.

I was for a long time extremely puzzled to account for the rapid changes which the pith balls on some days so frequently

exhibited; being positive one minute, then negative for another, and the next returning again to positive. From often considering this apparently whimsical changeableness in nature, I was at length induced to suspect, what indeed was afterwards confirmed by actual experiment, *viz.* that some of these changes are only apparent, and not real, they being occasioned not by the actual communication of a different sort of electricity, but merely by the action of electrical atmospheres; thus, when an electrified cloud comes within a certain distance of the rod, and before it comes near enough to impart to it some of its own electricity, the electrical atmosphere of the former, agreeable to the well known laws of electricity, will disturb the electric fluid naturally belonging to the rod, and will consequently occasion several apparent changes in the electrometer, which changes an unexperienced observer would attribute intirely to the change of electricity in the clouds.

This observation was evidently confirmed by the phenomena observed on the 31st of August; and thence it appears, that the real number of changes from positive to negative, or from negative to positive electricity, cannot be so great as it is shewn by the electrometer affixed to the rod.

I cannot help lamenting with Signor BECCARIA, that there are so few high pointed rods erected to ascertain the electrical state of the earth and atmosphere at all times; but more particularly during thunder storms. If there had been pointed rods, for instance, at Whitehaven and Lancaster on the 6th of October, and well attended to at the time of the storm of lightning and thunder, which happened at both places nearly at the same time, it would then have been known, whether the apparatus might not be positive at one place when it is negative at the other.



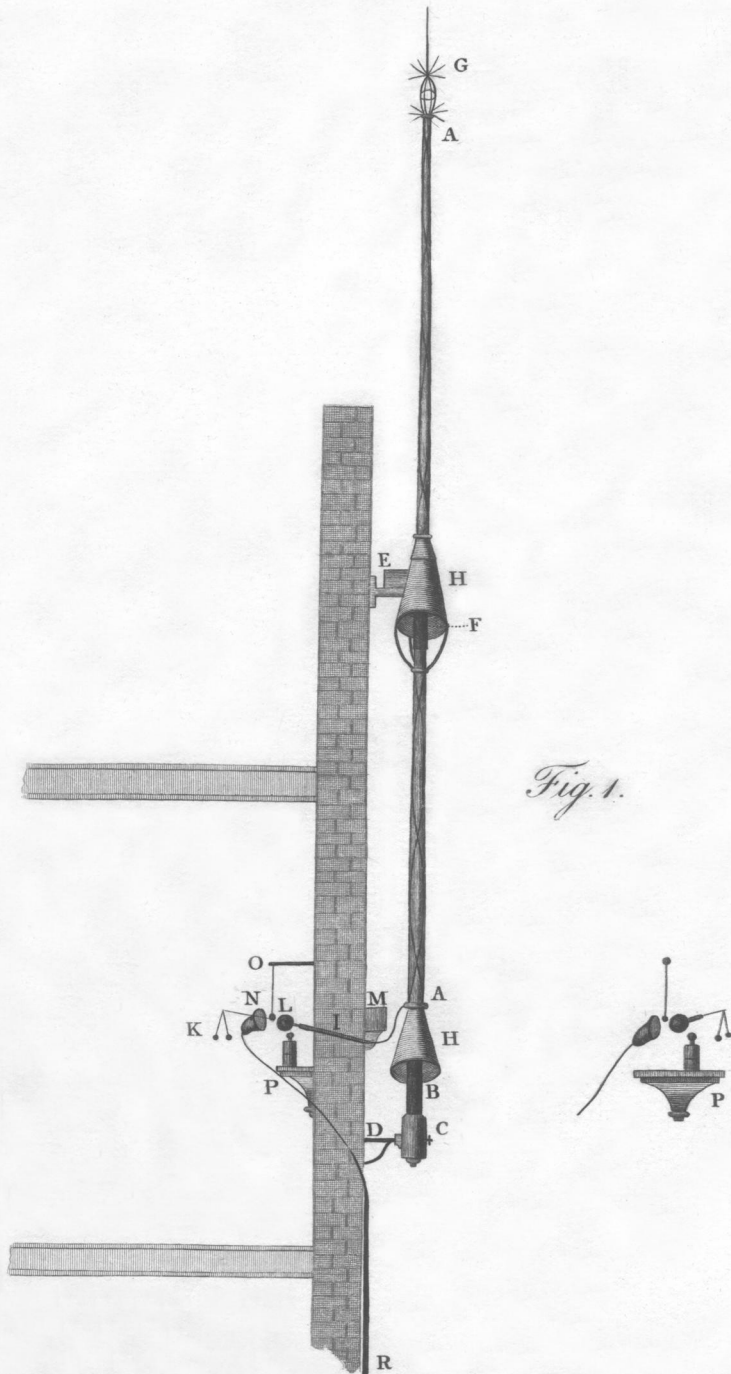


Fig. 1.